

CLAIMS

[1] An overheat protection device comprising a variable resistive element of which resistance varies depending on a temperature, characterized in that the device further comprises a switching element which controls a current flowing through an electrical system depending on an applied voltage thereto, and the variable resistive element is located on and thermally combined with a certain position of the electrical system and interrupts the current flowing through the electrical system by changing the applied voltage to the switching element when the certain position comes to be under a high temperature condition.

[2] The overheat protection device according to claim 1, wherein the electrical system comprises a secondary battery, and the variable resistive element is located on and thermally combined with the secondary battery.

[3] The overheat protection device according to claim 1 or 2, wherein the variable resistive element is a PTC element.

[4] The overheat protection device according to any of claims 1 to 3, wherein the variable resistive element is

composed of plural variable resistive elements which are electrically connected in series with each other.

[5] The overheat protection device according to any of claims 1 to 4, wherein

the overheat protection device further comprises a resistor,

the variable resistive element and the resistor are electrically connected in series with each other and in parallel to the electrical system, and

the switching element is electrically connected in parallel to the resistor.

[6] The overheat protection device according to claim 5, wherein

the switching element is an FET,

a gate of the FET is electrically connected to a position between the variable resistive element and one end of the resistor,

a source of the FET is electrically connected to another end of the resistor,

the source and a drain of the FET are electrically connected to form a part of an electric circuit comprising the electrical system, and

when a voltage between the gate and the source of the

FET becomes not greater than a threshold value, the current does not substantially flow between the source and the drain of the FET so that the current flowing through the electrical system is interrupted.

[7] The overheat protection device according to claim 6, wherein a value of the voltage between the gate and the source is expressed as a following formula (1):

$$V_{GS} = \frac{R}{P + R} V_0 \cdots (1)$$

wherein the V_{GS} is the voltage between the gate and the source, the V_0 is a voltage across the variable resistive element and the resistor, the P is a resistance of the variable resistive element, and the R is a resistance of the resistor.

[8] The overheat protection device according to any of claims 1 to 7, wherein the device further comprises other variable resistive element of which resistance varies depending on a temperature in order to prevent overcurrent in the electrical system.

[9] The overheat protection device according to claim 8, wherein the other variable resistive element is a PTC element.

[10] An electrical system comprising the overheat protection device according to any of claims 1 to 9.

[11] The electrical system according to claim 10, wherein the electrical system comprises a secondary battery which is electrically connected to an electrical element to form an electric circuit, and the overheat protection device is connected in parallel to and between the secondary battery and the electrical element.